

# High-Efficiency, Low-Temperature Regenerators for Cryocoolers, Phase I

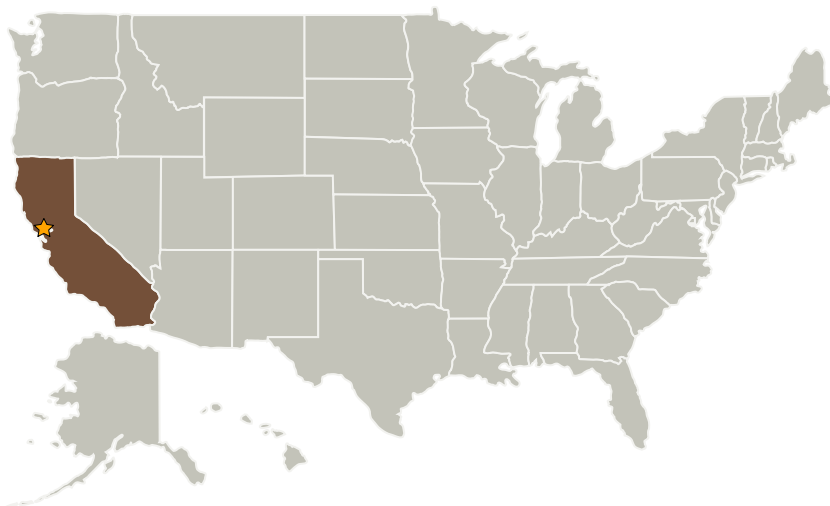
Completed Technology Project (2004 - 2004)



## Project Introduction

Future NASA planetary and astrophysics missions will require various enhancements in multi-stage cryocoolers. These include increased efficiency, reduced vibration and reductions in overall system mass and power consumption. For the small coolers required, pulse tube and Stirling coolers offer the best opportunities. At present, the efficiency of these coolers is limited by the effectiveness of low-temperature-stage regenerators. Below about 60 K, two factors play key roles in reducing the effectiveness of regenerators. One is that the heat capacity of most materials falls rapidly with decreasing temperature, thereby, severely limiting the number of useful materials to a few in common use. A second factor is that these commonly used materials are only available in powder form, a form known to raise reliability issues. In this effort, we will address both factors. We will use newly developed materials with high heat capacities at temperatures below 60 K, higher than that of commonly used materials. Further, we will develop a novel low-temperature regenerator matrix that will address both the aspect of high-efficiency and regenerator durability. Both the void fraction and the ratio of surface area to solid fraction of the regenerator matrix will be varied to achieve high efficiency.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Ames Research Center (ARC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Atlas Scientific	Supporting Organization	Industry	San Jose, California

## Primary U.S. Work Locations

California

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Ali Kashani

## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors